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Individual Differences in Whole-Part Approach and Flexibility-Rigidity in Problem Solving¹RALPH H. GOLDNER²

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INTRODUCTION

IN MOST studies of problem solving a general description of the problem-solving process has been arrived at in terms of the solution of the problem. There still remain several questions that would illuminate the problem-solving process in terms of the problem solver. For this investigation, there were selected two processes, related to "direction of problem solving" and to "adaptability." The first process, *Whole-Part Approach*, is concerned with the way the individual perceives the problem; the second process, *Flexibility-Rigidity*, emphasizes the way the person functions while solving problems.

MEANING AND DEFINITION OF
PROBLEM SOLVING

In this investigation, the meaning of problem solving is limited to one that would help explain the behavior of the problem solver. Brownell's (3) definition of problem solving was adopted. Accord-

ing to this definition, problem solving "(a) refers only to perceptual and conceptual tasks, (b) the nature of which the subject, by reason of original nature of previous learning, or of organization of the task, is able to understand, but (c) for which at the time he knows no direct means of satisfaction. Problem solving then becomes the process by which the subject extricates himself from his problem." In short, problem solving involves the goal-directed character of thinking, an obstacle to thinking, and a solution. But to delimit the definition further, this report restricts itself primarily and essentially to the *problem-solving process* in itself.

PROCESSES TO BE INVESTIGATED

Whole-Part Approach

The Whole-Part Approach determines one characteristic of the method used by the subject in problem solving. It has been noticed that some subjects approach problems as a whole while some others deal with parts of the problem. Thus, some persons, upon being shown a picture, will react to it in its entirety by calling it, e.g., a harvest scene, thus approaching the picture as an integrated unit or as a whole; others, seeing the same picture, will describe a segment or part of the picture by noting, e.g., a wagon, a man, corn stalks, thus approaching it through its parts.

¹ This monograph is based on a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy to the faculty of the University of Chicago. The writer wishes to express his deep gratitude to Benjamin S. Bloom for his patient direction and cooperation. In addition, appreciation is due Lee J. Cronbach, Ernest A. Haggard, and Ralph W. Tyler who assisted at various stages of the dissertation.

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Importance of the Whole-Part Approach

The Whole-Part Approach is an important problem-solving process for various reasons. It gives clues as to the individual's perception of the problem, his ability to organize parts into wholes. In addition, it seems to be related to personality variables and thus could account for individual differences in problem-solving behavior of people with similar intelligence-test scores.

Summarizing the discussion of earlier investigations which used concepts related to the Whole-Part Approach, the following findings seem to be important for the present study:

a. Several investigators have used the concept of Whole-Part Approach or similar concepts to describe the problem-solving behavior of normal and abnormal people.

b. There seem to be individual differences in the degree or extent to which normal individuals use the Whole or the Part Approach.

c. The Whole-Part Approach seems to be a process that can be observed in a variety of situations.

d. There is some indication that the Whole-Part Approach is consistent for the individual in a variety of situations.

e. It is a process that has meaning for everyday life situations.

f. It is a process that seems to have psychological meaning and seems to be related to personality characteristics.

Operational Definition of Whole and Part Responses

The review of investigations using the Whole-Part concept identified a variety of behaviors that have been taken as evidence of Whole-Part Approach in a variety of problem-solving situations. For convenience, the Appendix shows these behaviors classified as to Whole and Part Responses. This table will serve as a basis for arriving at an operational definition of Whole and Part Responses for the present investigation.

These earlier investigations seem to

suggest several aspects indicative of the Whole-Part Approach, namely, (a) manipulation of material, (b) speed of solution, (c) amount of material included in response or solution, and (d) plan of attack. The Whole-Part Approach as measured in this investigation combines these aspects. Considering the main aspects identified above, the characteristics of Whole Responses as well as Part Responses will now be described.

Whole Response. The subject usually does not manipulate material in a performance test but tries to think of a plan or a solution. He also proceeds to solve the problem quickly without further analysis. His responses include the whole area of the problem, or he may produce responses combining a great number of parts. Another characteristic is that the individual formulates a plan of action which he usually verbalizes.

Part Response. An individual using the Part Approach manipulates material readily and often produces responses in a random fashion. He usually takes a longer time working out a problem step by step. The subject responds only to one part of the problem at a time. He may break up the problems into parts and work out each one separately. He produces responses which combine only a small number of given parts. He usually has no particular plan of attack in mind, and when he verbalizes a plan it is only in terms of working out one part of the problem.

This report distinguishes between the words "Response" and "Approach" as used in Whole-Part thinking. A Whole Response or a Part Response is a single observation. Whole Approach or a Part Approach is the pattern resulting from a variety of responses. A Whole-Part Approach represents the over-all process that the person exhibits during problem solving. The conclusion is not to be drawn that subjects are classified as using either the Whole or the Part Approach. Rather, the Whole-Part Approach

represents a continuum ranging from preponderantly Whole Approach through Whole-Part Approach to predominantly Part Approach.

Flexibility-Rigidity Process

If one observes individuals solving problems in the course of their daily lives, one is aware of the great differences in the way people deal with problems. While some people will attack a problem in various ways, others are unable to shift to another attack even if their present performance does not bring the desired results. Some people can think only of one possible solution when they are confronted with a problem, while others are flexible enough to think of a variety of possible solutions. Certain personality characteristics and emotional states may limit the person's Flexibility, so that people with similar intelligence-test scores may be decidedly different in their problem-solving behavior.

Operational Definition of Flexibility-Rigidity

One of the purposes of this investigation was the identification of Flexibility-Rigidity as a problem-solving process. The emphasis was, therefore, on the observation of overt behavior which could be used to infer Flexibility or Rigidity.

Goldstein's (6) view of Rigidity seemed to apply mainly to impaired individuals showing an extreme degree of perseveration, while Fisher (4) limited the concept of Flexibility to situations where "alternative modes of behavior" are characteristics of a successful problem solution. In problem-solving situations both these aspects of Flexibility have to be considered. Not only must the subject continue to find another way of approaching the solution when his attack is unsuccessful, but at times he must find several possible solutions to a problem. Therefore,

the concept of Flexibility in problem-solving situations should include variety as well as variability of behavior. "*Variety*" would then stand for alternative solutions of the problems, while "*variability*" stands for behavior free from perseveration or behavior conducive to different attacks on the problem.

It is one of the hypotheses of this investigation that the structuring of a problem is an important aspect of the problem situation. If the problem is relatively unstructured as, e.g., in the Rorschach Test, variety and variability of response are possible and constitute an indication of flexibility. On the other hand, in several other tests, e.g., the Function Test, as mentioned later, the subject is *required* to arrive at alternative solutions and thus must show variety as well as variability of response in order to solve the problem.

In order to be able to deal with a number of different problems these aspects of flexibility have to be considered and must be included in an operational definition of Flexibility-Rigidity. For the purposes of this investigation it was found more advantageous to observe problem-solving behavior in terms of *Rigidity*, or *lack of Flexibility*. The operational definition of Rigidity used in this investigation is related to that of Werner (14), but has been adapted as follows: *Rigid behavior does not show variety or variability where variety or variability is either possible or required.*

It should be pointed out that the evaluation of variety of responses with respect to Flexibility-Rigidity has to be relative according to the particular population used in the experiment. Therefore, Rigidity of behavior does not necessarily mean pathological behavior but rather a decided difference of behavior from the rest of the subjects. Norms that have been set up to distinguish between normal and abnormal problem-solving behavior are not valid for this type of investigation that deals with the problem-solving behavior of normal subjects of superior intelligence.

Signs of Rigidity in the Experimental Situation

Before discussing the lack of Flexibility in the individual test situations, it is necessary to identify in general the behaviors that may be used to infer rigidity. Not all of the behaviors may be observed in the test situations. However, this dis-

cussion will serve as a guide to the observation of rigid problem-solving behavior during the experiment.

1. *Use of a similar attack on different problems*, as expressed through: (a) a decided preference for certain responses—in this study, an overemphasis on either the Whole or the Part Approach; or (b) an adherence to a particular attack on the problem—either (i) attending to the whole or part aspects of the problem by dealing first with the whole problem, then with the parts, and last with the minute details, or (ii) abandoning a progression from the whole to the part aspect of the problem and dealing with either whole or part of the problem exclusively.

2. *Limited production of responses*, in a problem situation in which the majority of subjects is able to produce many responses or solutions, is a sign of Rigidity. The amount of production that is labeled as rigid has to be determined on the basis of the performance of the majority of subjects.

3. *Absence or restriction of manipulation of problem material* in order to arrive at different responses is another evidence of rigid behavior, where such manipulation is appropriate or where it is generally true of other equal subjects.

4. *Lack of conceptual approach* is taken as a sign of Rigidity, especially in a person with more than average intellectual equipment. Besides changing the perceptual situation by manipulation of the problem material, the individual can change the conceptual situation by bringing to the problem other material that is not present perceptually or by looking at the problem in a different way. He may assume voluntary sets toward the problem; he may set up hypotheses which can be tested later on, or he may analyze the problem.

5. *Perseveration*. The degree to which a person can discard a response once made is indicative of his Flexibility in solving problems. There are two types of perseveration that have been observed in this investigation. In the first type the subject persists in giving the same response; he seems to be unable to restructure the situation, and he is relatively inactive in his problem solving. In the second type the subject may attempt some other responses but always comes back to the one he had made previously. Both types of perseverative behavior are indices of Rigidity and are treated together in this investigation.

6. *Lack of persistence in the exploration of the problem*. This is considered evidence of the inability of the person to restructure the problem.

7. *Presence of fluid, unorganized behavior*. This is characterized by the person's jumping from one aspect of the problem to another; by abandoning a product and starting again from the beginning; by verbalizing fluidity, as e.g., "My thoughts are so quick," "I forgot what I wanted to do," "After looking at it a while I get confused," "I am all lost."

These are the major signs of Rigidity that will serve as a basis for the evaluation of a person's Flexibility-Rigidity Process in the experiment.

PROCEDURE Population

The subjects were selected carefully with certain considerations in mind, namely high verbal ability, age, superior intelligence, and availability. It was believed that a selection of subjects who were homogeneous with regard to these variables would provide a critical test of the hypothesis that there are individual differences in problem-solving processes.

High verbal ability was important in this investigation in order to get sufficient verbalization during the experiments to infer problem-solving processes. Thus, it was decided to select a population that was older and that had a more than average amount of formal education. In addition, the population was to be of superior intelligence. Commonly accepted theories state that people with superior intelligence make greater use of the Whole Approach and also show a greater degree of flexibility than a less intelligent group.

It was finally decided to select first-year college students at the University of Chicago. By taking a first-year college group the chances were greater of getting a sufficiently large homogeneous sample with respect to the other factors mentioned above.

A population was selected with intelligence equivalent to the ninetieth to the ninety-fifth percentiles on the national norms on the American Council on Education Psychological Examination for College Freshmen (ACE).³ This test

³ For the University of Chicago the mean derived score is 20 with a standard deviation of 4.

had been administered about six months before the experiments were conducted and it was assumed that no significant changes would have occurred in the six months' interval.⁴ It should be remarked that students with these scores represented a group slightly above the average of the general college population at the University of Chicago.

Another restriction to secure a more crucial test of the original hypothesis was that the Quantitative (Q) and Linguistic (L) score on the ACE Test should not differ significantly. It was thought that extreme differences in Quantitative and Linguistic scores may in some instances be an indication of either special abilities or of personal maladjustments, and might therefore introduce another variable into this investigation. Thus, only students whose Quantitative and Linguistic scores did not differ more than two points or one-half a standard deviation were selected.

To increase further the homogeneity of the sample, the results on two additional entrance examinations, that had been administered six months before the present experiments, were considered. These were the results on the Reading Comprehension Test and on the Writing Skill Test. It was decided to exclude students whose scores differed more than four points or one standard deviation from their respective total ACE scores. This would further eliminate people with special aptitudes, and provide for a more crucial test of the hypotheses.

The sample that was finally used in this investigation was selected from the records of the Board of Examination at the University of Chicago. Nineteen students, who fitted the criteria mentioned above, were selected to participate in the experiment: 12 men and 7 women.

Voluntary participation was believed to provide the proper motivation for this experiment. The investigator wrote a letter to each of the selected individuals inviting them to participate in the experiment at a time convenient for them.

The population selected had total scores ranging from 23 to 25. Therefore, the difference in total scores between 23 and 25 is only one-half a standard deviation.

⁴These records of the entrance examination were available to the investigator through the courtesy of the Board of Examinations at the University of Chicago.

This letter was followed up with a telephone call to assure participation of a large number of selected individuals.

Rationale for Choosing Tests and Their Description

In order to secure evidence for the inferring of problem-solving processes and to test the hypotheses about individual variation and individual consistency, the tests selected had to meet the following criteria.

1. Each test should involve a task requiring a maximum degree of overt action, including verbalization.

2. The tests should vary in degree of structure and should represent a variety of content. Variety in degree of structure is important in order to test the hypothesis that an individual is consistent with respect to his problem-solving processes in structured and unstructured situations. With a variety of task-content, greater and more accurate generalizations can be made with regard to the processes observed.

3. Each test should be unstructured to such a degree that individual ways of attacking the problem are possible—and thus, when they exist, individual differences can be inferred.

These are some of the major criteria to be considered in the selection of special tests for the observation of problem-solving processes. The following six tests were selected for the experiment because they appear to fulfill the criteria cited above. The tests are presented roughly in order of structure.

Rorschach Test

This test satisfied each of the criteria. It represents an unstructured situation in which the subject can attack the problem in a variety of ways and can give a variety of responses. He can react to the whole or only to part of the inkblot. The test contains perceptual as well as conceptual situations. The responses to the inkblot reveal the subject's perception of the blot. This is aided by the inquiry after the initial administration.

To what extent does this test represent a problem-solving situation? The subject has been asked to report everything he sees in the inkblot. He has not only to differentiate certain parts of the blot but he has to assign meanings to the percepts that are related or fairly close to the reality of the situation. He has to decide for himself how he wants to deal with the problem. No hints are given how the responses will be scored. It is, therefore, possible for the examiner to determine how the individual sees the situation, and how he deals with the problem.

Evidence of Whole-Part Approach. The evidence of Whole or Part Responses has been stated in earlier investigations. In this test the amount of material or area of the card included in the response is the determining factor:

1. *Whole Response:* the subject responds to the inkblot as a whole; he takes in the whole area of the blot.

2. *Part Response:* the subject responds to parts of the inkblot separately; he responds to minor parts of the inkblot.

It is the relative amount of Whole and Part Responses in all the 10 cards that determines the Whole-Part Approach of the subject.

Scoring procedure of Whole-Part Approach. All 19 records were scored according to Beck's method (2), and the number of W-, D-, and Dd-responses recorded. The number of W-, D-, and Dd-responses given by each subject were then divided by the total number of responses of the subject in order to determine the emphasis with which the subject responded to the Rorschach cards. Then the W%-scores of the group were arranged in a frequency distribution to determine the rating as to Whole-Part Approach of the subject. After considering Beck's (2) formulation of "normal" approach (20%W-67%D-13%Dd), and observing natural breaks in the distribution of W%-scores, ratings as to Whole Approach were given as shown in Table 1. By assigning these ratings, a person's Whole-Part Approach could be compared with his Whole-Part Approach in the other tests.

Evidence of Rigidity:

1. W%, 35% or more; D%, 80% or more; Dd%, 25% or more.
2. Number of cards with systematic sequence or with no succession: nine or more.
3. Number of cards with only one response.
4. No turning of cards when total responses are 35 or less.
5. Number of movement responses: three or less.
6. Organization score (Z): 20 or less.
7. F%: 55% or more.

TABLE 1
ASSIGNMENT OF WHOLE APPROACH RATINGS
IN THE RORSCHACH TEST

W%	Whole Approach Rating
45 and over	Very High (VH)
30-44	High (H)
15-29	Medium (M)
10-14	Low (L)
0-9	Very Low (VL)

8. Number of determinants used: seven or less.

9. A%: 45% or more.

Scoring procedure of Flexibility-Rigidity. Each record was scored according to Beck's (2) method. These scores were then arranged in a table and the nine categories giving evidence of rigid behavior examined. The decision as to rigid behavior was partly determined by a review of the available literature and also by the distribution of scores for this particular group, because the standards that applied to abnormal behavior were not always meaningful when applied to this group.

In order to arrive at a total score of rigidity for each subject, the number of categories showing rigid behavior were added for each individual. Thus, subject No. 6 showed rigidity in three out of the nine categories, and therefore received a score of 3. Although a weighting scheme was contemplated, an adequate basis for assigning weights does not seem to exist at this stage of our knowledge. The total scores were then arranged in a frequency distribution and ratings were assigned as discussed in a later section.

Function Test

Description. A test was needed that would represent a verbal conceptual situation, that would be relatively unstructured, and that would bring out a person's Whole-Part Approach. The writer, therefore, developed the "Function Test." This test consists of four problems. The task in this test consists of supplying several different uses for (a) a box, (b) a broom, (c) pliers, and (d) paper. It represents a relatively unstructured situation since no hints are given with respect to possible scoring, number of responses, or time limits.

Administration. The subject is asked: "What are the possible different uses of _____ (box, broom, pliers, paper)?" The investigator makes a verbatim record of the subject's remarks during the administration of the test. The subject deals with each object until he exhausts all the possibilities. There is no time limit. At the end of each problem the investigator makes a short inquiry to discover how the subject went about solving the task.

Evidence of the Whole-Part Approach. The analysis of the data indicates that an individual can deal with the object as a whole by leaving the object intact, or he can break up the object into parts and deal with the parts separately. Subject No. 7 responded to problem "Box" by dealing with it as a whole: (a) to stand on; (b) to fill it full; (c) mail packages; (d) wastebasket; (e) deliver in boxes; (f) mail box; (g) coffin; (h) cigarette boxes.

Subject No. 7 gave only one Part Response to "Box," namely "bonfires," thus breaking up the original configuration. Subject No. 11 gave as a Part Response to "Box": "Take it apart and make something else." His Part Responses to "Broom" were: "(a) take handle and use it as another implement—e.g., if you need another piece of wood; (b) straw to feed a horse or cow, or whatever eats it." Thus, in this test, those responses that described the use of the object as a whole are designated as Whole Responses, while responses that deal with the use of part of the object or that destroy the configuration of the object are called Part Responses. It is the relative amount of Whole and Part Responses in the four problem situations that determines the Whole-Part Approach of the subject.

Scoring procedure of the Whole-Part Approach. Each response by the subject was evaluated with respect to Whole Approach or Part Approach in accordance with the criteria stated above. The number of Whole and Part Responses was added, and a total score derived for each of the four tasks in this test. Then the total scores, which represented the number of responses, were computed for each subject with respect to Whole-Part Approach.

In order to arrive at an evaluation of the emphasis on the Whole or Part Approach for the individual, the number of Whole Responses was divided by the total number of responses and the percentage of Whole Responses computed. These percentages were then arranged in a frequency distribution and ratings were assigned to indicate the emphasis on W-Approach as shown in Table 2.

Evidence of Rigidity. This test is mainly a conceptual situation. In order to solve this problem the subject has to restructure the object and attempt to see its uses in a variety of situations.

TABLE 2
ASSIGNMENT OF WHOLE APPROACH RATINGS
IN THE FUNCTION TEST

W%	Whole Approach Rating
95-100	Very High (VH)
92- 95	High (H)
81- 91	Medium (M)
74- 80	Low (L)
Below 74	Very Low (VL)

A person who is flexible will be able to give many uses for the object, uses that are different in general idea (e.g., box: container, support, etc.). Thus, the number of general ideas offered becomes an index of flexibility. Subjects who offer only 12 general ideas or less in the whole test situation (four problems) are considered rigid.

Scoring procedure of Flexibility-Rigidity. Each response by the subject was evaluated with respect to the general idea represented. Thus, responses for the different possible uses of a box such as "to pack things," "for mailing," "as a nest," "as a tool box" were scored as belonging to the category "container." Responses such as "to sit on it," "as a foot rest," "to stand on" were scored under category "support." Among other categories were "fuel," "striking instrument," "wedge," "float," "writing surface."

The number of general-idea responses was added for each problem and the results for each problem examined in order to evaluate the individual's behavior with respect to rigidity. The scores for each problem were arranged in a frequency distribution, and ratings of High, Medium, or Low were assigned with respect to rigidity.

In determining these ratings, it appeared advantageous to assign the High and the Low ratings to the upper and lower 25% to 33% of the subjects, i.e., five to six persons at each end. It was thought important also to consider natural breaks in the frequency distribution, as well as the median score before ratings were assigned. A rating of "High" was assigned to the upper 25% to 33% of the scores, a rating of "Low" to the lower 25% to 33%, and a rating of "Medium" to the remaining scores in order to arrive at a Rigidity Rating for each problem.

In order to arrive at a total Rigidity score for the individual on the Function Test, the ratings of all four problems were added by assigning a value of 5 to a "High," 3 to a "Medium," and 1 to a "Low" Rigidity Rating. This method of totaling the ratings reflects the relative standing of the individual in the particular test situation.

The total Rigidity scores for the Function Test were then arranged in a frequency distribution in order to obtain a final Rigidity Rating for each individual on the Function Test. Again the upper 25% to 33% of the scores received a rating of "High," the lower 25% to 33% a rating of "Low," and the remaining scores a rating of "Medium."

Using the same method of scoring on the other tests, it was then possible to compare an individual's final Rigidity Rating on one test with his final Rigidity Ratings on the other tests.

Anagram I Test

Description. One way to observe process would be to put the subject in a situation where he would have an opportunity to manipulate materials. Sargent (13) had used anagrams. However, his subjects solved the problems without overt manipulation of letters. Therefore, the writer developed the "Anagram Test" consisting of two parts. The test consists of 14 wooden letters (C D E E I N O P R S S T U V), and the subject is asked to make words out of these letters. This was a relatively unstructured situation in which the subject could do what he thought was demanded by the situation.

Administration. The subject is told: "See what words you can make out of these letters!" There is no time limit but the test is stopped after about 10 minutes when most of the subjects have exhausted the possibilities. Any questions with regard to structure are answered with, "This is up to you." The investigator wrote down the words constructed. The observations included the amount of manipulation and placement of letters and any verbalizations.

Evidence of Whole-Part Approach. A subject using a Whole Approach in this situation will attempt to combine a great many letters in one word; he will produce big words. A person using Part Approach will be satisfied to produce smaller words. Thus, with respect to amount of material included in the response, the number of letters in a word is taken as a criterion of Whole or Part Response. In this experiment a word of five letters or more was considered a Whole Response. The division of five letters or more was arrived at arbitrarily after a study of

the test results revealed that the median was four letters. The words consisting of five letters and more represented 16% of the total responses given by all the subjects. Thus, at five letters there seemed to be a natural break in the distribution, distinguishing large from small words. A word of four letters or less was taken as a Part Response.

The Anagram I Test was selected as a less structured situation. Since the production in the first half of the test seemed to be less limited than that in the second half, the first half of the subject's responses was used to evaluate the person's Whole-Part Approach. The data showed a slight shift toward larger words in the second half of the test (see Table 3).

In order then to determine the person's Whole-Part Approach in a less structured situation, the relative amount of Whole and Part Responses in the first half of the individual's production has been used. An individual who starts out producing small words in the first half of the test may be forced to produce larger words in the second half because the production of small words becomes less possible.

Scoring procedure of Whole-Part Approach. In accordance with the criteria mentioned above, all the words containing five or more letters were scored as a Whole Response. A score for Whole Responses was computed for the first half of each individual's responses, dividing the number of words with five or more letters, occurring in the first half of the test, by the number of responses in the first half, as shown in Table 3. These scores were arranged in a frequency distribution and ratings were assigned with respect to Whole Approach. (Some individuals may remain at the same level as in the first part of the test, i.e., they keep on producing small words. Others produce small words in the second half after having produced bigger ones in the first half.)

TABLE 3
PERCENTAGE OF WORDS WITH SPECIFIED NUMBER
OF LETTERS: FIRST AND SECOND HALF
OF THE ANAGRAM I TEST

Part of Test	Number of Letters in Word					
	2	3	4	5	6	7
First Half (Responses = 467)	6%	41%	36%	12%	3%	1%
Second Half (Responses = 467)	4%	32%	40%	15%	7%	2%

Evidence of Rigidity. (a) Those persons who produce more than 50% of two- and three-letter words in the first half of the test are considered as showing a certain amount of constriction in the spontaneous reactions to the problem. (b) Those subjects who keep on producing 50% or more small words in the second half are considered as showing an even greater degree of constriction. (c) Those subjects who show a decided increase in production of small words in the second half of the test (over 10%) may have become more constricted when the situation became more structured; or they may have become less motivated.

The problem in this test is to make words. Nothing is said about the quantity, quality, or any other features of the words. Nothing is said about the manner in which the subject should proceed in constructing the words. He may continue to use the same letters and change the words mechanically (e.g., pit, pet, put, pot). If his production of words is restricted to this type of procedure he usually produces only small words. This behavior is taken as a sign of constriction in this investigation. If the percentage of words constructed by this perseverating method is 50% and above, it is considered evidence of rigidity.

Scoring procedure of Flexibility-Rigidity. The test was scored for each individual in accordance with the criteria stated above. The two- and three-letter words produced by the subject were added up for the first half of his production as well as for the second half. The number of small words in the first half was then divided by the total number of words produced in the first half and the percentage computed. The same procedure was used with small words produced in the second half.

Since the number of large and small words produced in the first half and in the second half was the same, the percentage of gain or loss in the production of small words was computed by comparing the percentage of small words produced in the first half with the percentage of small words produced in the second half.

Each record was scored with respect to the method with which the words had been produced:

1. Subject builds up words: e.g., pot—post; pin—spin.
2. Subject breaks down words: e.g., rinse—rise; pride—ride.
3. Subject changes vowel in the middle of the word: e.g., strive—strove; tone—tune.
4. Subject holds on to same letters and changes only the first letter: e.g., sip—nip—tip—dip; tries—dries—cries.

The number of words produced by each of

these four methods was then added and a score computed. In order to arrive at an evaluation of rigidity this score for each person was divided by the total number of words produced by the subject and the percentage of words produced by these four methods computed. The number of repetition of words was also noted for each person.

In order to arrive at an estimate of a person's rigidity in the Anagram I Test, the total scores of each category were arranged in a frequency distribution and ratings assigned, as discussed in the section above. Similarly, total Rigidity scores were computed and then arranged in a frequency distribution and final ratings assigned in order to make it possible to compare a person's behavior in the Anagram I Test with his behavior in the other tests.

Anagram II Test

Description. This situation represents a more structured one than the Anagram I Test. The subject is asked to construct one word out of all the 14 letters given (C D E E I N O P R S S T U V). These letters form the word "Productiveness." This word had been chosen because it was suitable for a variety of approaches and seemed to have the correct level of difficulty as determined by a few preliminary administrations. (Only one subject solved the problem during the actual experiment.) It also lent itself to the construction of several large words, an important aspect in the observation of the Whole-Part Approach.

Administration. The subject is told: "Try to make one word out of these letters!" There was no time limit but the test usually lasted 10 minutes. The subject was observed while he was trying to construct one word out of all the letters. During this time his moving of the wooden letters and his verbalizations were recorded. These records were then used to determine what the subject attended to and how he went about solving the problem.

Evidence of Whole-Part Approach. This represents a more structured situation, as the individual is asked to combine all the letters in one word. Besides considering the amount of material included in the response as in the Anagram I Test, the manipulation of the letters is taken as evidence of Whole or Part Responses. Lack of manipulation of the wooden letters and

"thinking of words" is taken as evidence of a Whole Response. On the other hand, ready manipulation of letters as well as construction of words in a random manner is taken as evidence of a Part Response. Furthermore, with respect to the amount of material included in the response, the production of prefixes and suffixes or working out a small part of the word separately is taken as evidence of a Part Response. Subject No. 10 used first a Part Approach by arranging letters as to vowels and consonants, and then by putting the two S's together. He used a Whole Approach by thinking of words like "vicissitude," "visualization." He verbalized this Whole Approach by saying that he was thinking of several words having sufficient length. After seven minutes of thinking of words he shifted to a Part Approach: "Maybe a trial-and-error process is better—and E in the back is probably . . .—assuming it began with a consonant an S as initial, for convenience let E follow it; let another consonant follow—N—; I have to put more than one consonant together—we'll run out of vowels!—'sent'—that doesn't recall a word."

The Whole-Part Approach of an individual was determined by the relative amount of Whole and Part Responses observed and recorded during the performance.

Scoring procedure of Whole-Part Approach. Each individual record was examined in accordance with the criteria set up above. Thus, every performance was evaluated as to evidence of Whole or Part Approach. Whenever there was evidence of the Part Approach a "D" was recorded. A "W" was recorded when there was evidence of the Whole Approach. If there was only slight evidence of Part or Whole Approach a (D) or (W), respectively, was noted. Then an over-all judgment was made as to Whole-Part Approach. These ranged from "pure Part Approach—D" through "mostly Part Approach—D(W)," "combination Whole-Part Approach—DW," to "mostly Whole Approach—W(D)." A final rating as to Whole Approach was assigned to each individual's performance: a rating of W(D) and a rating of DW were considered "High" in Whole Approach, a rating of D(W), "Medium" in Whole Approach, and a rating of D, "Low" in Whole Approach.

Evidence of Rigidity. (a) Produces only prefixes. (b) Produces mainly words. (c) No production of words or prefixes. (d) No succession of sequence. (e) No manipulation of letters. (f) Number of words produced (4 or less). (g) Does not mix up letters in pile. (h) Does not ask himself questions. (i) Does not set up hypotheses. (j) Does not think of words. (k) Makes same errors. (l) Thinks of earlier large word. (m) Gives up.

Scoring procedure of Flexibility-Rigidity. Each

record was examined as to the presence or absence of behaviors that could be taken as evidence of rigidity as stated above. In order to arrive at a total score of rigidity for each subject, the number of categories showing rigid behavior were added for each individual. Thus, subject No. 1 produced only prefixes, showed no succession of sequence, did not manipulate letters, did not mix up letters in pile, and did not set up any hypotheses. His total score was 5. The total scores were then arranged in a frequency distribution and final ratings were assigned as discussed in an earlier section.

Stencil Design Test II

Description. This test (see reference 1) was selected because it involves overt action in a relatively highly structured perceptual situation. It consists of 20 design cards in black and white, each three inches square, and 24 colored stenciled cards, also three inches square. Twelve of these colored cards are yellow, and 12 are blue. There are 11 stencils and 1 solid card of each color; they are numbered in the order in which they are to be arranged on the table when presented to the subject. All the colored cards are reversible so that no time is lost if a card is laid face down. Both the design cards and stencils are symmetrical to avoid difficulty with right-left or up-down reversals. The object is to superimpose blue cards and yellow cards upon each other to form a design similar to the one on the black and white design card.

For this study only five designs were selected for the experiment proper, namely, numbers 9, 13, 10, 18, 19 (1). These designs were selected to provide the proper difficulty and different possible problem-solving approaches for a superior group of students. Problems 10 and 19 can be solved by the Whole Approach whereby the subject has to analyze the design, i.e., determine which stencils are involved. These two problems cannot be solved easily by trial-and-error or by sheer mechanical approach. In contrast,

problems 9, 13, and 18 could be solved mechanically, by placing stencils of alternate colors on top of each other.

Administration. In the Stencil Design Test the subject is shown a sample card and given the following directions: "Make a design with these stencils so that it will look like the drawing on this card." If the subject does not understand the task, the examiner shows him that the pattern could be copied by placing the blue stencil on the yellow solid card. The stencils are returned to their places. To make certain that the subject understands the directions the examiner asks him to copy design number 3 as a practice exercise (1). If the subject does not yet comprehend the directions he is given design number 5 for further practice. After the subject understands the directions, he is given designs number 9, 13, 10, 18, 19 in that order. The order of presentation is held constant for each subject in order to control any possible influence of one design on the following one. Besides that, this specific order calls for changes in attack so that a mechanical approach to the problems has only a limited chance for successful solutions. The subject is told that there is no time limit on the task. Furthermore, he is encouraged to verbalize what he is thinking, how the problem looks to him and what plans he has to attack the problem. If a subject feels hampered by talking out loud, he is not prodded. Any question by the subject as to procedure, etc., is answered with, "That is up to you."

Movements of stencils and verbalizations by the subject during the performance were recorded by the investigator. A special notation was developed by the investigator to record the movement of stencils. This enabled the investigator to evaluate the responses after the test was completed and did not call for immediate judgment or rating of the performance. As mentioned before, verbalizations were recorded as were pauses, glances at the designs or at the stencils; qualitative observations as, e.g., rapid movements or impulsiveness were noted in the record in proper sequence. In addition, the time of first response, i.e., picking up of a stencil, was recorded as was the total time taken for each problem.

Evidence of Whole-Part Approach. This is one of the more structured situations, and a variety of behaviors was taken as evidence of Whole and Part Responses:

1. **Manipulation of material:** Lack of manipulation of stencils was taken as evidence of a Whole Response while frequent manipulation was taken as a Part Response.

2. **Speed of solution:** Putting stencils together

without much checking back to the design and producing the solution rapidly was taken as a Whole Response, while arriving at a solution after a relatively longer time was taken as evidence of a Part Response (13).

3. **Amount of material included in response:** The following behaviors were considered as evidence of a Whole Response; the individual states relationship of several stencils; he states in inquiry that he looked at the problems as a whole. Evidence of a Part Response: during the inquiry, the individual states that he knew one stencil, color, form; he states that he was looking for a circle, etc.; he notices minor projections, points, etc.; he places stencils one at a time; he divides problems into separate parts; he works out parts separately and then combines them.

4. **Plan of attack:** As a Whole Response, the individual spends a major part of the time on the analysis of the design; he analyzes the problem in terms of stencils needed; he verbalizes a complete plan of attack. As a Part Response, the individual analyzes the problem for each stencil separately.

The relative amount of Whole and Part Responses determines the Whole-Part Approach of the individual.

Scoring procedure of Whole-Part Approach. The performance of each subject was rated on each of the five tasks with respect to Whole-Part Approach in accordance with the criteria set up above. These ratings were added in order to arrive at a total score for each individual. A frequency distribution was made of the total scores, and each subject was given a final rating with respect to Whole Approach on the basis of his position in the distribution.

Evidence of Rigidity. In order to evaluate rigidity of an individual in this test situation several behaviors were considered.

1. The subject makes the same errors and shows perseveration in this way.

2. The subject holds on to the same wrong stencils for more than one response. He does not recognize his mistake and does not discard the wrong stencil.

3. The subject misses cues. He seems to be unable to look at the problem differently.

4. The subject uses the same attack on the problem.

Scoring procedure of Flexibility-Rigidity. Each of the five problems was examined and scored separately as to (a) number of same errors, (b) number of wrong stencils (form) held, (c) number of missed cues, and (d) number of times same attack was made on the problem. These scores were then combined for each problem into a total score by adding up the number of occurrences of these behaviors. The total scores

were then arranged in a frequency distribution and ratings as to rigidity assigned. It should be noted that problems that were not completed by the subject received a rating of "High" rigidity.

In order to arrive at a total estimate of the individual's behavior with respect to rigidity in the Stencil Design Test, the total scores of each of the five problems were arranged in one table. By assigning a score of 5 to "High" ratings, 3 to "Medium" ratings, and 1 to "Low" ratings, a total Rigidity score for the Stencil Design Test was arrived at. Then the total Rigidity scores were arranged in a frequency distribution and final ratings assigned in order to facilitate a comparison between the different tests.

Block Design Test

Description. The Block Design Test (8) is another example of a highly structured test. The four designs used in this investigation were presented in red and white, each three and one-quarter inches square, mounted on a white five-by-eight inch card. Sixteen identical blocks, each a one-inch cube having a side colored with red, white, blue, yellow, blue-yellow, red-white, respectively, were used to reproduce the designs. The designs are drawn in such a way that a block is represented three-sixteenths of an inch smaller than in reality. This size was chosen because it allowed the design to be large enough to be adequately examined, and it made the task more difficult than if the design had been reproduced in its true size.

The changes incorporated by the writer in the Block Design Test cause it to differ from the one used by Kohs (8). One change consisted in leaving out the boundary lines which (in the Kohs set) gave the designs a square outline. It was now more difficult to find a beginning and to analyze the design. All the designs were drawn the same size, in contrast to the Kohs test. This leaves it up to the subject to determine what size he should reproduce. In addition, in order to increase the number of possible approaches, the subject was always given all of the 16 blocks, and it was up to him to decide to use all or only some of the blocks.

The designs used in this investigation varied as to complexity. Problems 1 and 3 represented

designs with clearly defined outlines, while Problems 2 and 4 were more complex. Problem 2 was the only one that had a square outline. In the other designs the figure was not square.

Problems 1 and 3 were also chosen because they lent themselves to a construction with four blocks instead of sixteen blocks.

With respect to Whole-Part Approach it was thought that Problem 3 would be mainly attacked by the Part Approach, while Problem 4 would lend itself more to a Whole Approach. In Problem 3 the figures stand out separately, while Problem 4 is too much of a whole to break it up into any figures.

Administration. In the experiment, the subject was given all the 16 blocks in random arrangement and also the Design 1. He was told, "Make a design with these blocks so that it will look like the drawing on this card." There was no time limit. The subject was again encouraged to think out loud while he was working on the problem.

Movements of blocks and verbalizations by the subject were recorded. In order to record the movements of blocks, the special notation proposed by Rubinstein (12) was used. At times, it became necessary to draw the designs as constructed by the subject when his production became very different from the expected one. Furthermore, pauses and qualitative observations were recorded in addition to verbalizations and moves. Also, the time of first response and total time for each problem were made part of the record.

Evidence of Whole-Part Approach. If the subject approaches the problem as a whole, he may proceed to complete the problem row by row regardless of the design (6). He may verbalize this Whole Approach, or he may show it in his performance, which is usually quick and smooth. If he employs the Part Approach, he may break up the design into parts which he completes separately; or he may complete the problem step by step, checking carefully after each step. Usually, in this approach, the subject follows the pattern or design of the problem.

The relative amount of Whole or Part Responses determines the subject's Whole-Part Approach.

Scoring procedure of Whole-Part Approach. As in the Stencil Test, the performance of each subject was rated on each of the four tasks with respect to Whole-Part Approach in accordance with the criteria set up above. These ratings were added to arrive at a total score for each individual. A final rating for Whole Approach was assigned to each subject on the basis of his position in frequency distribution of total scores.

Evidence of Rigidity. In order to evaluate rigidity of an individual in this test situation

several scores were considered:

1. The subject has difficulty in size perception and does not adjust to the given design.
2. The subject does not change his attack on the problems after failure.
3. The subject abandons part-product although it was correct.
4. The subject gives up trying to solve the problem.
5. The subject jumps from one aspect to another.
6. The subject verbalizes fluidity or lack of organization.
7. The number of errors is high.
8. The subject does not correct errors.
9. The subject repeats errors.
10. The subject holds on to wrong blocks.

Scoring procedure of Flexibility-Rigidity. Each of the four problems was examined and scored separately as to the presence or absence of behaviors that could be taken as evidence of rigidity as stated above. These signs were then added for each subject in each problem.

In order to arrive at a total estimate of a person's behavior with respect to rigidity, the scores of the individual in each problem were added and total score computed. This procedure was used because the range of behavior was not great enough to make a separate rating for each problem meaningful. The total scores were then arranged in a frequency distribution and final ratings assigned as discussed in an earlier section.

Experimental Procedure

The battery of tests was administered to each student individually in two sessions of two hours each. In the first session the Stencil Design Test, Anagram I and II Tests, Block Design Test, and the Function Test were presented in that order. This sequence of problems was believed to avoid boredom and poor motivation by changing tasks from perceptual to verbal ones. This sequence was held constant for all of the subjects.

In the second session, the Rorschach Test was administered and the inquiry conducted. The purpose of presenting the Rorschach Test as the last problem was to make certain that the investigator did not have any bias in the observation of problem-solving behavior because

of information received through the Rorschach Test. Another advantage of presenting the Rorschach Test last was that the subjects did not suspect that any personality variables were being observed. The Rorschach Test could have been detrimental to the experiment because it was known by most of the subjects as a clinical instrument for the evaluation of personal maladjustments and would have aroused anxieties in some of the subjects.

The recording of responses has been discussed in a previous section. It may be worthwhile to point out again that initial response time and total time for the task were recorded, with the examiner using a stop watch.

The examiner sat at the right side of a table observing the movements of the subjects. He recorded moves or verbalizations immediately on sheets of paper. The investigator had developed a shorthand system for the recording of moves in the performance tests. The subject was asked to verbalize thoughts, but was not urged further if it disturbed his performance. The room was a cubicle in the Psychological Laboratory of the Education Department at the University of Chicago. It was possible to work without any interruption.

RESULTS AND DISCUSSION

Whole-Part Approach

Individual Differences

The group showed variability with respect to emphasis on Whole-Part Approach in the Rorschach Test, the Function Test, the Anagram I Test, the Anagram II Test, and the Grace Arthur Stencil Design II Test. The evidence as to individual differences was meager in the Block Design Test. For detailed data, see reference 5.

Consistency of Whole-Part Approach

In order to arrive at a measure of consistency of the Whole-Part Approach, correlations between the various tests were obtained as shown in Table 4. According to Lindquist the value of r re-

TABLE 4
INTERCORRELATIONS OF SIX TESTS WITH RESPECT TO WHOLE-PART APPROACH

Test	Function	Anagram I	Anagram II	Stencil	Block	Total Score Minus Particular Test
Rorschach	.25	.40	.40	.58	.40	.67
Function		.00	-.02	-.02	.10	.08
Anagram I			.25	.53	.36	.48
Anagram II				.29	-.03	.27
Stencil					.62	.66
Block						.48

quired for significance for 19 subjects at the 5% level of confidence is .456, and at the 1% level is .575 (9). The correlations between the Rorschach Test Score and the total scores of the other five tests, and between the Grace Arthur Stencil Design II Test and total scores, yielded a coefficient of .67 and .66 respectively. These correlations are significant at the 1% level. The correlations between the Anagram I Test and total scores, and between the Block Design Test and total scores are both .48. These correlations are significant at the 5% level. The results show that the Function Test measures different behavior from the other tests in the battery. In general, the tests seem to indicate a fair degree of consistency of Whole-Part Approach for the individual, as well as significant differences among individuals.

Flexibility-Rigidity Process

Individual Differences

The group showed variability with respect to Flexibility-Rigidity in the Rorschach Test, Function Test, Anagram I Test, Anagram II Test, Grace Arthur Stencil Design II Test, and Block Design Test (5).

Consistency of Flexibility-Rigidity Process

In order to investigate whether Flexibility-Rigidity is a consistent process, correlations between final Rigidity ratings on the various tests were calculated (see Table 5). The correlations of the single tests with the total score yield results that are significant on the 5% level or better for the Rorschach Test ($r = .54$), the Block Design Test ($r = .54$), and the

TABLE 5
INTERCORRELATIONS OF TESTS FOR 19 SUBJECTS WITH
RESPECT TO FLEXIBILITY-RIGIDITY

Tests	Unstructured Tests			Structured Tests			Total Score Minus Particular Test
	R	A I	F	B	St	A II	
Rorschach		.51	.42	.26	.17	.10	.54
Anagram I			.19	.00	-.19	-.30	.06
Function				.16	.32	.25	.43
Block Design					.83	.34	.54
Arthur Stencil Design						.50	.58
Anagram II							.30

Grace Arthur Stencil Design II Test ($r = .58$). These results indicate a fair degree of consistency of the Flexibility-Rigidity Process.

Although these tests seem to correlate to some extent with the total score, it is interesting to note that there is no significant correlation between an unstructured test on the one hand and a structured test on the other. The degree to which a problem is structured is evidently of importance.

The correlation between Flexibility-Rigidity in the Anagram I Test and Anagram II Test is .10. If the content of the test were influential in determining Flexibility-Rigidity scores, these two tests should correlate significantly. There is thus an indication that content enters only to a small degree into the results on Flexibility-Rigidity Process.

This conclusion is reinforced by the examination of the intercorrelations of the Stencil Design Test, the Block Design Test, and the Anagram II Test. The Stencil Design Test and the Block Design Test correlate .83. This correlation is very high and may be in part explained by the similarity of the tests. Both tests include manipulation of materials and analysis of spatial relationships. If the content of the test were the major factor, the tests should not correlate with the Anagram II Test. However, the Stencil Design Test and the Anagram II Test correlate .50, which is significant on the 5% level of confidence. The correlation between the Block Design Test and the Anagram II Test is only .34 and, therefore, statistically not significant. The common factor among the three tests is the structure of the situations. Thus, the correlation between the Stencil Design Test and the Anagram II Test can be explained not on the basis of content but on the basis of structure of the situation.

The Function Test shows an unusual pattern in that it correlates with some of the unstructured and some of the structured tests. This can in part be explained by the differences in structuredness of the four problems comprising the test (e.g., "paper" constitutes an object

with a relatively small degree of structure, while "pliers" represents an object with a relatively high degree of structure).

These correlations imply that individuals who are rigid in the Rorschach Test may also behave rigidly in other unstructured situations. On the other hand, subjects who are rigid in the Stencil Design Test may behave rigidly in other structured problem situations.

Relationship of Whole-Part Approach to Flexibility-Rigidity Process

The investigation of Whole-Part Approach and Flexibility-Rigidity Process raises the question whether these processes are independent of each other. Therefore, product-moment correlations were computed; the results are presented in Table 6.

In order to interpret the intercorrelations it should be remembered that the final ratings for the Whole-Part Approach signified the degree of Whole Approach present, while the final ratings of the Flexibility-Rigidity Process represented the degree of Rigidity a person exhibited in the problem situation.

When the correlations between the Whole-Part Scores and the Flexibility-Rigidity Scores for each test were computed, neither the Rorschach Test nor the Anagram I Test showed a relationship between the Whole-Part Approach and Flexibility-Rigidity Process. This indicates that the measures used in these two tests are independent of each other.

The Anagram II Test, the Stencil Design Test, and the Block Design Test showed a statistically significant relationship between scores for the Whole-Part Approach and Flexibility-Rigidity Process (correlations of $-.57$, $-.54$, and $-.66$, respectively). The negative correlations indicate that a person who rates high

TABLE 6
INTERCORRELATIONS BETWEEN FINAL RATINGS OF WHOLE-PART APPROACH
AND FLEXIBILITY-RIGIDITY PROCESS

Whole-Part Approach	Flexibility-Rigidity Process						
	Rorschach	Function	Anagram I	Anagram II	Stencil Design	Block Design	Total Rating
Rorschach	—						
Function	-.03	.03	-.21	-.37	-.24	-.12	-.25
Anagram I	.26	.54	.15	.20	.13	.19	.41
	-.36	-.13	-.32	.00	-.20	-.27	-.34
Anagram II	.09	-.29	-.10	-.57	.00	.08	-.22
Stencil Design	-.25	-.18	-.15	-.51	-.54	-.38	-.60
Block Design	.06	.12	.19	-.33	-.66	-.66	-.36
Total Rating	-.07	-.13	-.02	-.41	-.41	-.31	-.33

in Rigidity will rate low in Whole Approach. This result is in line with clinical findings on the Rorschach Test.

The results indicate, then, that the unstructured tests show Flexibility-Rigidity Process and Whole-Part Approach as two separate processes, while the more structured tests seem to use similar behaviors as evidence for both Whole-Part Approach and Flexibility-Rigidity Process.

The Function Test shows a correlation of .54 between scores for Whole-Part Approach and Flexibility-Rigidity Process. The Function Test has been shown earlier to be a test that seems to measure different behavior from the other tests.

SUMMARY AND IMPLICATIONS

Review of the Plan of the Study

A battery of six tests involving verbal or perceptual problems, and varying from less structured to more structured, was administered to a group of 19 college students. This group was a highly homogeneous population with respect to age, amount of education, total and subscores in the ACE test, reading comprehension test scores, and writing skill test scores.

The individual test records were analyzed to determine the subjects' scores on

Whole-Part Approach, and on Flexibility-Rigidity Process.

Summary of the Results

Whole-Part Approach

The group showed variability with respect to Whole-Part Approach in all six test situations. Correlations between each test and the total score (see Table 4) were significant for the Rorschach Test and the Stencil Design Test at the 1% level, and for the Anagram I and the Block Design Test at the 5% level. The results indicate a fair degree of consistency of Whole-Part Approach for the individual.

Flexibility-Rigidity Process

The group showed variability with respect to Flexibility-Rigidity Process in all of the six test situations.

The correlations of three single tests with the total score yield results that are significant at the 5% level or better. These results indicate a moderate degree of consistency of the Flexibility-Rigidity Process. However, there is no significant correlation between Flexibility-Rigidity scores on an unstructured and a structured test. On the other hand, correlations among the unstructured tests show

significant correlations, as do also correlations among the structured tests. This would indicate that Flexibility-Rigidity Process is fairly consistent for the individual on tasks that are similar in structure, but not consistent for tasks that differ in structure (see Table 5).

Relationship of Whole-Part Approach to Flexibility-Rigidity Process

The correlations of Whole-Part scores and Flexibility-Rigidity scores among unstructured tests are not significant, while the correlations among structured tests are statistically significant. This would indicate that the unstructured tests show Flexibility-Rigidity Process and Whole-Part Approach as two separate processes, while the more structured tests seem to use similar behaviors as evidence for both Whole-Part Approach and Flexibility-Rigidity Process (see Table 6).

Conclusions

The findings of this study seem to justify the following conclusions:

1. Problem-solving processes can be inferred from observation of problem-solving behavior in special tests.
2. A group of subjects homogeneous as to intelligence shows individual differences with respect to Whole-Part Approach and Flexibility-Rigidity Process.
3. The Whole-Part Approach is a fairly consistent process for the majority of the subjects in situations that differ

as to content and degree of structure.

4. Flexibility-Rigidity is a fairly consistent process for the individual on tasks that are similar in structure, but not for tasks that differ in structure.

5. Whole-Part Approach and Flexibility-Rigidity are two separate processes when observed in less structured situations; in more structured situations the two processes are more closely related.

Implications

Problem solving has mainly been looked upon as purely intellectual behavior. However, the Whole-Part Approach and the Flexibility-Rigidity Process are variables that have often been related to an evaluation of personality characteristics. Thus, an investigation of problem-solving processes may reveal how the individual reacts in certain problem-solving situations, and it might lead to other measures of "functioning or effective intelligence."

A focusing on process makes it possible to make finer differentiations of intellectual functioning among individuals at the superior level of intelligence. The differences are then not due to the fact that a subject solves one more problem than the other subject, but rather to the problem-solving processes used.

The investigation of problem-solving processes also leads to an explanation of why subjects fail to solve certain problems. This information is usually not available if one deals mainly with the end products of the problem-solving activity. One has then to be content to state that the subject cannot solve analogy problems, numerical problems, etc.

It should also be pointed out that the problem-solving processes which have been identified lend themselves to cutting across content categories. Whole-Part Approach and Flexibility-Rigidity are processes that can be identified in problems of a verbal, spatial, or numerical nature.

APPENDIX

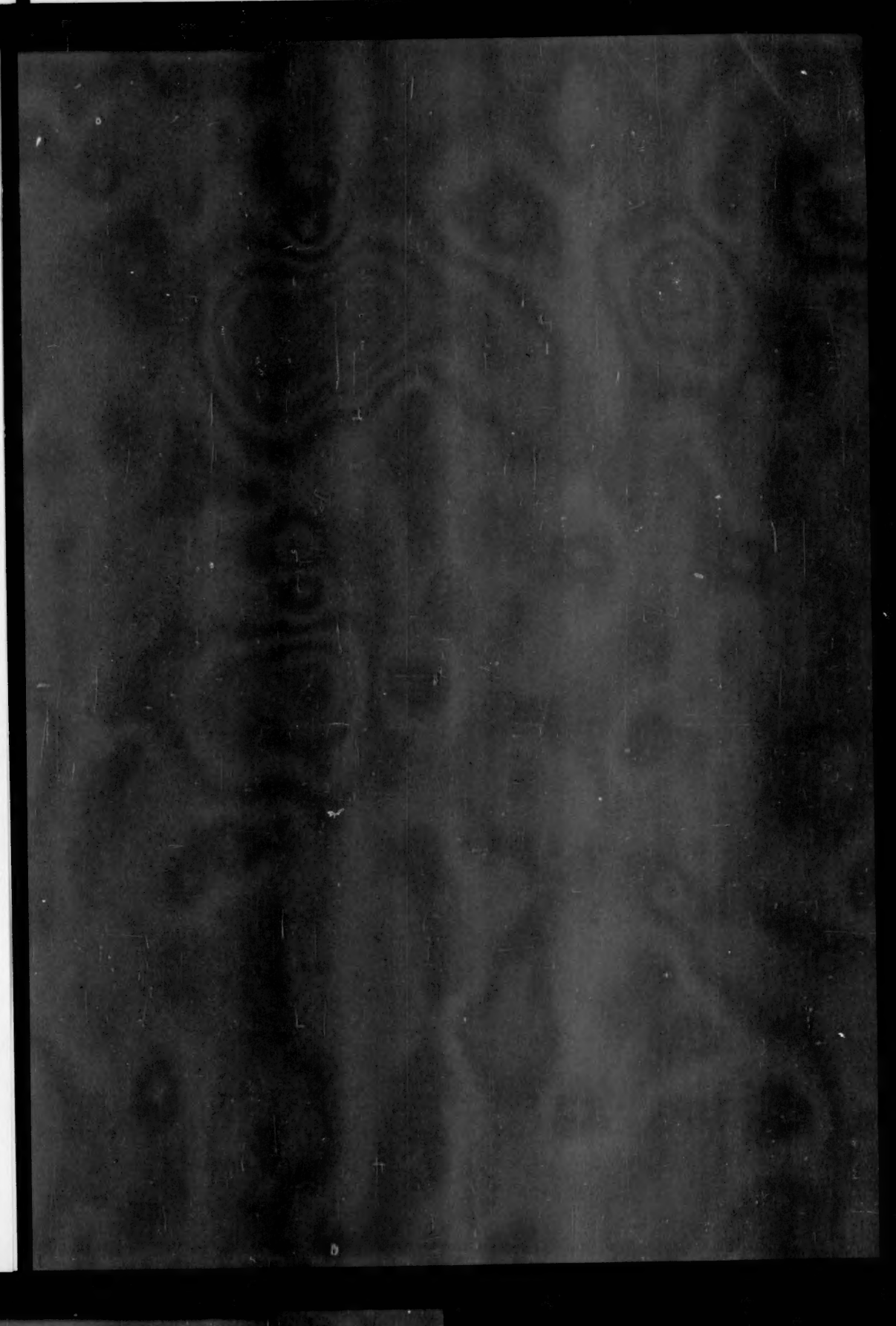
BEHAVIORS IDENTIFIED IN EARLIER INVESTIGATIONS AS RELATED TO WHOLE-PART APPROACH

Whole Response	Part Response
Sargent (13)—Looking at letters with no attempt to form syllables or combinations. —A rapid solution in the first few seconds.	—Forming combinations of letters without any definite plan. —Seeking a common prefix or suffix. —Making usual consonant-vowel-consonant combinations. —Trying one letter at a time with all the others. —Combining letters at random. —Solution emerges slowly in steps.
Rorschach (11)—Responds to area as a whole.	—Responds to part of the area.
Hanfmann (7)—Formulating hypotheses in thinking without much paying attention to blocks. —Handling and moving of blocks is reduced to a minimum.	—Keeps in constant touch with material. —Gets ideas from looking at blocks and handling them. —Has groupings first and formulates principles afterwards.
Rapaport (10)—Passive speculation, with little or no manipulation of blocks.	—No attempts are made to organize impressions into generalizations.
Goldstein (6)—To plan ahead ideationally. —To abstract common properties reflectively, to form hierarchic concepts. —To hold in mind simultaneously various aspects.	—To concentrate on a single aspect of a situation. —Thinking and acting are directed by the immediate claims which one particular aspect of the object or of the outer-world makes.

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